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LAMBTON TGS ASH STORAGE AREA
FUTURE OPERATING GUIDELINES

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Guidelines for operating the Lambton ash storage area over the 6 year period from 1988-1993 are presented. These guidelines are provided as a means of achieving a final design profile for the storage area while controlling fugitive dust emissions from the site. Shaping of containment berms, capping of inactive fill areas, minimizing the area of active ash filling, regular inspection and standby dust control equipment are key elements in this plan.

1.0 INTRODUCTION

Civil Research assistance in the preparation of an environmental control document was requested by the Environmental Protection Department. The task of providing guidelines for the next 6 years of operation was assigned at a planning meeting on March 18, 1988. Dust control is the major objective of these future operating guidelines.

2.0 BACKGROUND

Located in the northeast corner of the site (Figure 1), the ash storage area at Lambton TGS has a design life of 33 years. Eighteen of these years have passed to date. It is assumed that the ash pile design is based on 2:1 horizontal to vertical side slopes and a maximum height of 12 m (40 feet) similar to the original design height of the neighbouring coal pile/1/. Recent re-evaluation of the soil supporting the coal pile has allowed the design height to increase to 18 m (60 feet)/2/. A comparable final design height may be possible in the ash storage area. However, a review of the underlying soil properties and appropriate slope stability analyses should be done to establish this greater height limit.

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The ash storage area was originally depressed below the elevation of adjacent land and enclosed by 2 to 3 m high clay berms. Ash generated by plant operation has now raised the area well above the adjacent land elevation. Contours of the site derived from aerial photography flown in late 1987 are shown in Figure 2. Cross sections of the area show parts of the ash stack are approaching the assumed 13 m (40 foot) height limit (Figures 3 and 4). While some of the fly ash has been dressed with earth cover and bottom ash cover has been placed over portions of the fly ash fill, other parts of the site employ no permanent dust control features. Water trucks must be relied upon to treat these areas whenever weather conditions causing dust emissions occur. Apart from the above dust control measures and a general prohibition against placing ash on windy days, dust control at the site is not currently a well ordered process.

3.0 WIND SPEED AND DIRECTION

Local wind data/3/ shows winds from the north, west or south are equally likely (Figure 5). Dust studies at Nanticoke TGS/4,5/ showed that ash became airborne when wind speeds exceeded 30 km/hr. At Lambton TGS, Figure 6 shows that winds that would cause ash dusting are predominantly from the west.

4.0 STORAGE AREA SEQUENCING

To protect active ash placing activities from the prevailing west wind, the overall filling of the area should proceed from west to east. To promote drainage of surface runoff and ash leachates to Lake Lambton, a south to north filling sequence is desirable. Enclosure berms to the west and south of the working area should be raised first. Placing of ash should then proceed behind and preferably below the top level of these berms, working in a southwest to northeast direction. The area northeast of Pond #2, south of Lake Lambton and west of the North-South haul road should be filled first. The area east of the North-South haul road should follow (see Figure 7).

5.0 CONTAINMENT BERMS

Enclosure berms for the work area will form part of the finished exterior of the completed ash storage area. They may also serve as access for the ash hauling trucks. As such, more care in their construction is warranted. Construction of these berms in summer may be most favourable as station operation is reduced and weather is best for earthwork.

As lifts of ash are normally 3.65 m (12 feet) thick at Lambton TGS, the containment berms should be constructed about 4 m (13 feet) high. A 2 horizontal to 1 vertical exterior slope is recommended. This slope should be dressed with 0.15 to 0.30 m (6 inches to 12 inches) of clay, which is available locally, and planted with grass.

Construction of the berms in 0.3 to 0.5 m lifts, using truck and bulldozer for compaction, is recommended. Native clay, bottom ash or fly ash may be used to construct these berms. If fly ash is used for this purpose, the conditioning water added at the silos should be increased to approximately 25%, on a dry weight basis, to facilitate compaction. A final surface layer of 0.3 m bottom

ash on the crest of the berm is suggested to support truck traffic during wet weather.

6.0 WORKING AREA

One of the most important changes that can be made in the fly ash landfill operation is to restrict the size of the active work area. By restricting the area of active filling and covering the inactive areas, the area of the ash storage site having the potential to generate dust is reduced to a controllable size. Based on energy forecasts for Lambton TGS, ash production for the years 1988 to 1993 is expected to range from 45,000 m^3 to 192,000 m^3 (Figure 8) with the lower volumes occurring towards the end of this time period. These ash volumes are similar to the ash production volumes considered from Lakeview TGS when planning the Canada Brick (formerly Domtar) ash landfill/6,7/. The bulk of the ash at Lambton is produced in the winter months (Figure 9) as was the case at Lakeview. To accommodate dumping, spreading and compacting operations at the Canada Brick site, a working area of 1 hectare was used in the winter and one half hectare or less was used in the summer/6,7/. These fill areas were based on raising the active area 2.5 m per annum using 0.3 m lifts to achieve structural fill compaction. Since 3.6 m lifts have been commonly used at Lambton and compaction equipment is not employed, a work area much smaller than that used at Canada Brick can be considered. In the winter of high ash production years (1988-1991), a working area no larger than 0.5 hectare is recommended. For summer operations, an area on the order of 0.15 to 0.25 ha is appropriate. During low ash production years (1992-1993), these areas may be reduced approximately in half. The actual area required in these later years will depend on the proportion of winter to summer ash, which are currently not predicted, and the accuracy of the forecast. Since departures from forecast ash production are not unusual, an adequate area should be enclosed by berms each summer/fall to receive the following winter's ash production.

As each working area of 0.5 ha or less is completed, it should be covered. Depending on ash production, covering material may need to be applied at 2 to 4 week intervals. Figure 10 shows a typical fill and cover sequence.

As experience is gained and future operating plans are clarified, the size of these active operating areas may be adjusted, keeping in mind the original intent to minimize the size of this potential dust source.

7.0 COVER OF INACTIVE AREAS

All areas of the ash storage area not actively in use for ash placing should be capped or sealed to prevent dusting. The native clay soil, bottom ash and chemical dust control agents can be used for sealing these areas. A 0.30 m thick clay cover is recommended for permanent features of the storage area such as the slopes enclosing ponds and exterior slopes of confining berms for the main fill containment. This clay cover should be seeded with grass or other ground cover vegetation to keep it in place.

For temporary covers, a thinner layer of clay is the most reliable approach. However, this material may have to be removed or selectively punctured to

promote vertical drainage before placing overlying lifts of fly ash. Bottom ash is useful as a dust cover but may have to be augmented by chemical sealers to resist rainfall erosion. Quantities of bottom ash may not be adequate for initial coverage of inactive areas. Furthermore, bottom ash has an economic value in the local marketplace which may be higher than the cost of importing clay. At Nanticoke TGS, considerable work has been done to evaluate chemical dust control agents/8,9/. Several products have been found effective for summer and winter use. Conditions at Lambton TGS, where the surface of the ash is not saturated, are well suited to the use of chemical agents. However, most chemical agents need to be reapplied periodically making their use expensive as a medium long term protection. They are a quick and easily applied treatment for short term cover conditions.

8.0 SURFACE GRADING

To retain surface runoff from the fly ash within the borders of the ash disposal area and direct it towards Lake Lambton, the ash surface should be sloped towards Lake Lambton. A slope of at least 1% is suggested. Where runoff water must travel long distances or cross haul roads, temporary swales can be used to collect and transport the water to the collection pond. A ridge should be constructed along the crest of the access road to prevent runoff from escaping along this conduit.

Inactive areas should be smoothed to as flat a surface as possible to reduce the surface area of ash exposed to drying and dusting to a minimum. Where drainage must be directed down steep or long slopes, consideration should be given to forming steps in the slope and lining major drainage paths with bottom ash or coarse stone to prevent erosion. To reduce runoff quantities stored in Lake Lambton, clean runoff from ash areas with permanent or long term "temporary" clay cover may be directed off site subject to further investigation. Extra clay should be placed along water courses for erosion protection.

9.0 HAUL ROADS

Haul roads within the ash storage area are a significant source of dust. Limiting the length of these roads, avoiding roads that align with the critical West to East wind direction and regular water treatments are required to control dust from this source. A bottom ash and/or crushed gravel topping can be used for the semi-permanent access ramp to the storage site. Use of covering materials within the site is impractical as they will become quickly contaminated by ash lodged in the haul truck tires. Chemical dust control agents are generally not resistant to traffic loads and are also rendered ineffective due to new ash dropped from the hauling trucks. Regular treatment of the haul roads with water is the only practical control method for dust. This regimen must be followed conscientiously to ensure haul road dust is controlled.

10. TRAFFIC PATTERN

To protect the active ash disposal area with Westerly berms and avoid haul roads aligned with the critical wind, haul road access from the West should be removed. The current South entrance should become the sole access route to

the area. Within the ash area, trucks should follow a standard route while each seasonal "cell" of the storage area is raised. Routes should be selected to achieve the dual objectives of accommodating traffic flow and minimizing the length of road exposed to potential dusting. Suggested traffic routes are shown on Figure 10.

11. DUST CONTROL EQUIPMENT

Lambton TGS should maintain at least one vehicle dedicated to dust control of the ash storage area. A water tank truck with at least 3,000 gallons capacity is suggested. The prime use of this vehicle will be haul road treatment. Equipping the vehicle with a high power directional spray nozzle is recommended. This is the only way to guarantee treatment of slopes and surfaces in the working area which are too loose to support the water truck during high wind "emergencies".

12. INSPECTIONS

High winds leading to dust emission events can occur at any time of day or any day of the week. These conditions may go undetected unless station staff are required to inspect the ash area on a regular basis and are authorized to activate "emergency" dust control action when required. At the Canada Brick storage site, security personnel were required to inspect the ash landfill during off hours (ie, evenings and weekends) as part of their duties. Dust emission developments were to be communicated to senior operating personnel who had the authority to call in the water truck operator. A similar inspection and control system should be implemented at Lambton TGS.

Seasonal inspections of permanent dust control features such as the clay cover and slope vegetation is desirable as a mechanism for detecting damage and initiating repairs. Observation of the site during the occasional rain event should be undertaken to ensure drainage features are functioning as intended.

13. CONDITIONING WATER

Dry ash collected in the station's silos is conditioned with approximately 10 - 15% water by weight before being trucked to the storage area. The amount of water added and uniformity consistency of water content in the ash is not well controlled/10/. The station should consider increasing the water content to at least 20% to facilitate both compaction of the ash and dust control. Consideration should be given to improving the dustless unloading equipment and operator training to achieve uniform water addition to the ash and avoid dry ash entering the truck at the start and end of each load. No ash should be placed on the site that has not been properly conditioned with water. While the water truck can be used to improve the water content of poorly conditioned ash, it is not as effective as the silo equipment for this purpose. It should not be used for conditioning dry ash, except as a last resort when ash cannot be routed through the dustless unloaders.

14. DUST MONITORING

A dust monitoring program should be instituted to gauge the effectiveness of the dust control initiatives taken at the site. At Canada Brick/7/ five dust

fall jars, located along the downwind property boundaries, and one off site, high volume sampler formed an acceptable monitoring program. Dust fall jars are sampled monthly. The high volume sampler requires daily sampling. Monthly dustfalls were compared to community standards while daily records allowed correlation with wind events. A similar amount of sampling is suggested for the Lambton TGS dust monitoring program. Due to the proximity of the ash storage area to the property line, downwind monitoring locations are encouraged if suitable site for the instruments can be obtained and maintained. Possibly the wood hydro poles on the concession roads downwind of the plant can be used for this purpose. Details of the monitoring program will be provided by the Environmental Protection Department.

An analysis program should be planned to separate the dust fractions due to coal, ash and natural soil collected in the dustfall jars. Microscopic examination has been used with some success for this purpose. These sampling points should be inspected regularly and replaced, if needed, as they are frequently vandalized in some locations.

15. SUMMARY

A general plan of operations to control dust in the ash storage area at Lambton TGS has been presented. Ash placing operations should be sheltered from the prevailing west wind by confining berms. The area of active ash placement should be kept to a minimum consistent with seasonal energy output of the station. All other parts of the storage area should be sealed to prevent dust. Options for surface sealing were presented. Traffic should be restricted to areas downwind of the confining berms. Haul roads should be regularly watered to control dust. Regular inspections and an "emergency" dust control plan should be instituted. A program to monitor dust downwind of the station and assess the contribution of ash to dust emisions is recommended. This will provide feedback to station staff on the effectiveness of their dust control program.

The appropriate height limit for the ash storage area is an unresolved issue that was outside the scope of this study. Investigation of local soil strength and slope stability analyses are recommended to establish the design height for this area.

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CBHC:LM

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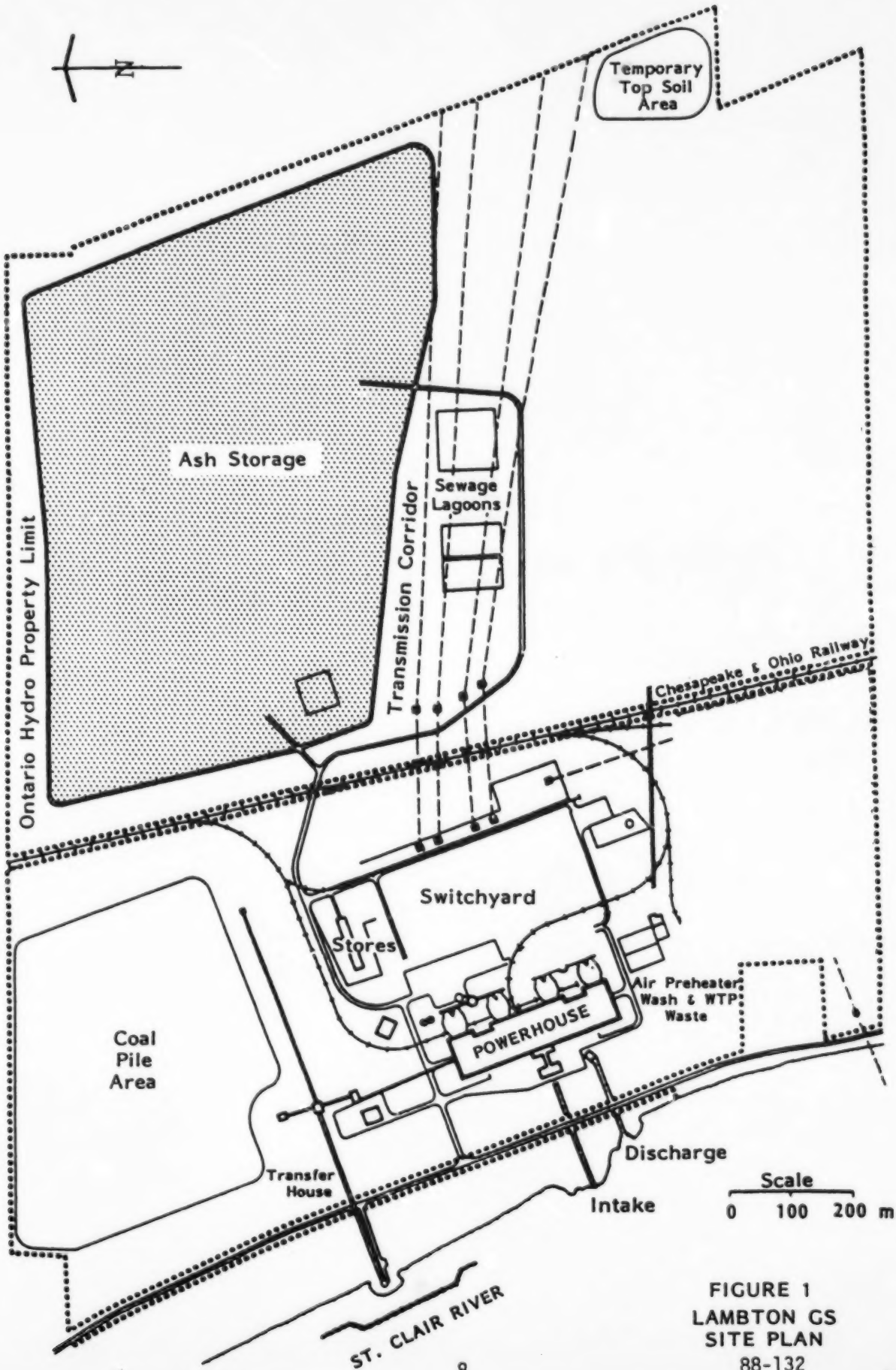

FIGURE 1
LAMBTON GS
SITE PLAN
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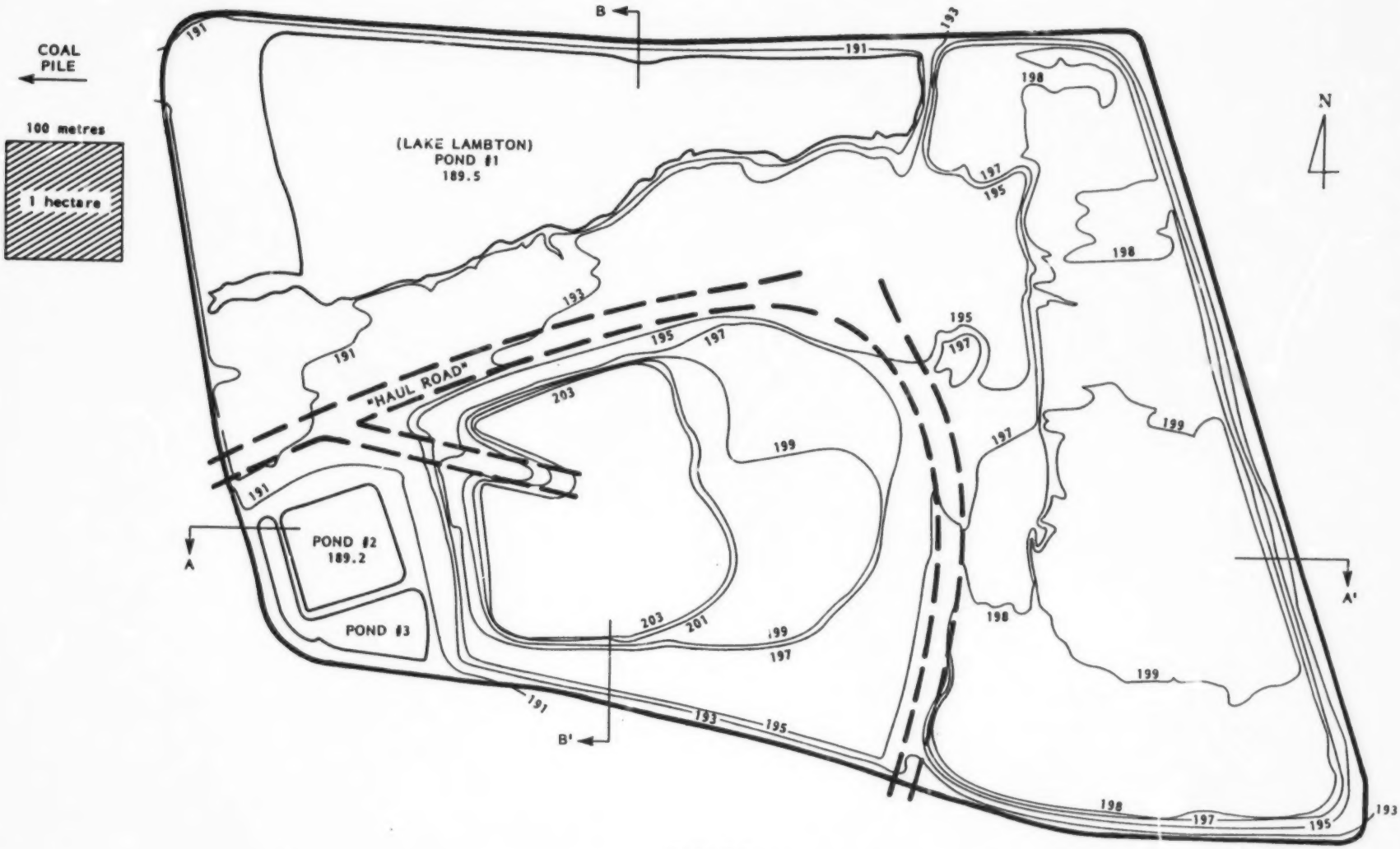

FIGURE 2

LAMBTON TGS

ASH STORAGE AREA CONTOUR PLAN 1987

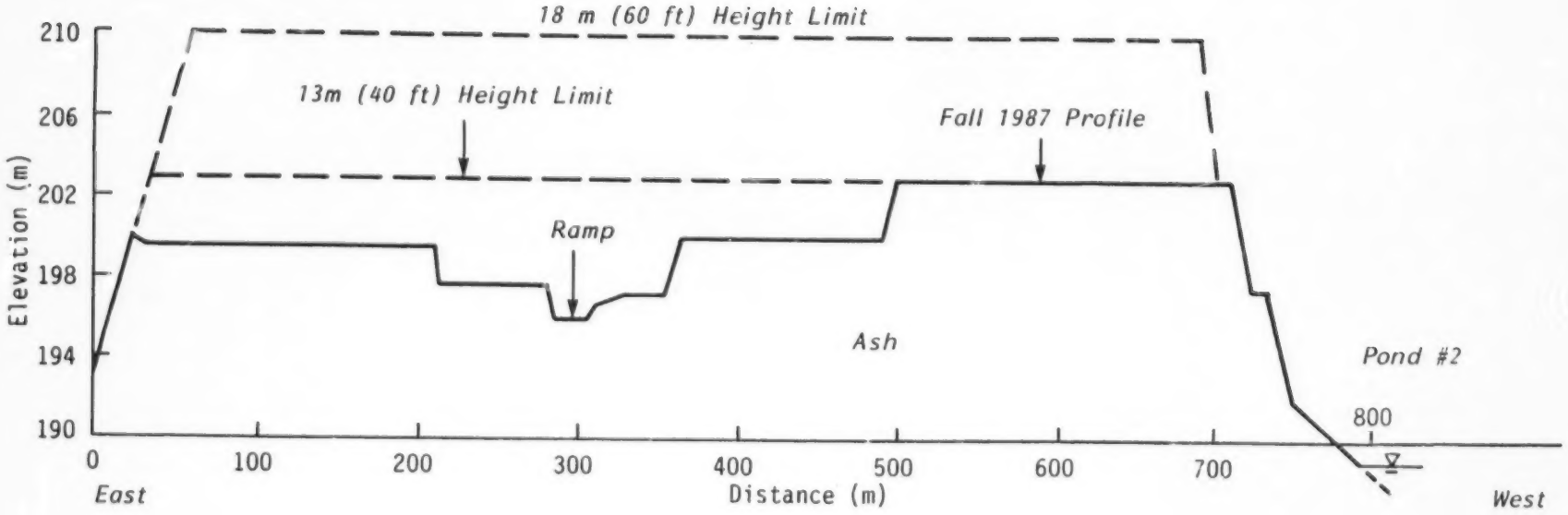

FIGURE 3

LAMBTON TGS ASH STORAGE AREA
SECTION A - A'

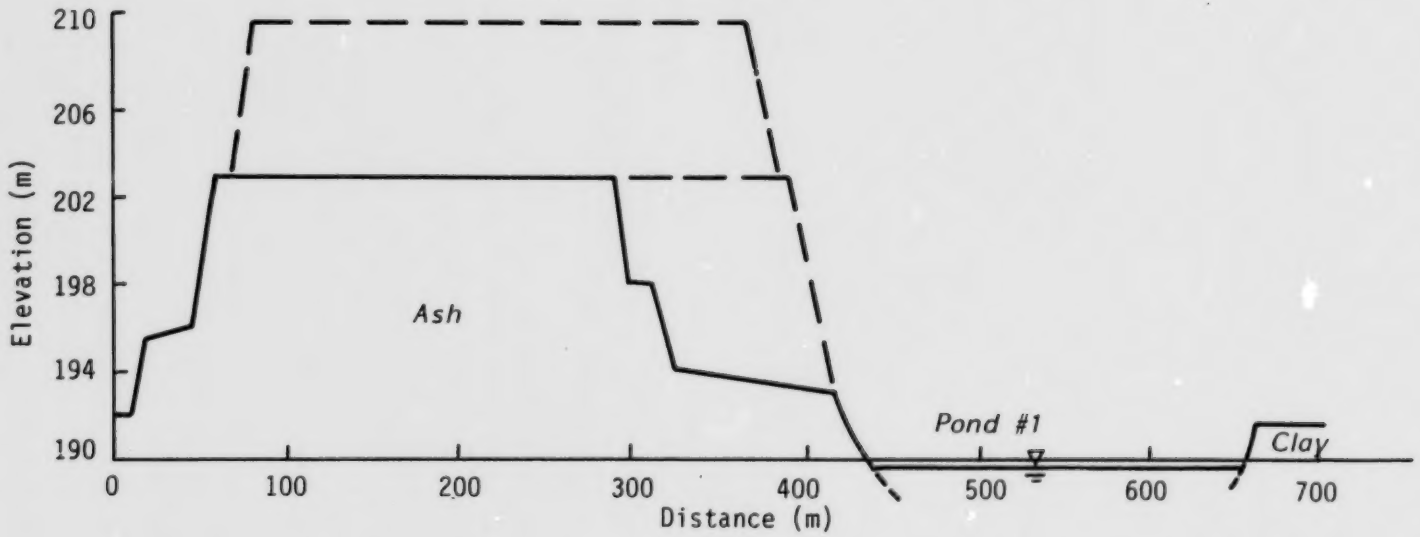

FIGURE 4

LAMBTON TGS ASH STORAGE AREA
SECTION B - B'

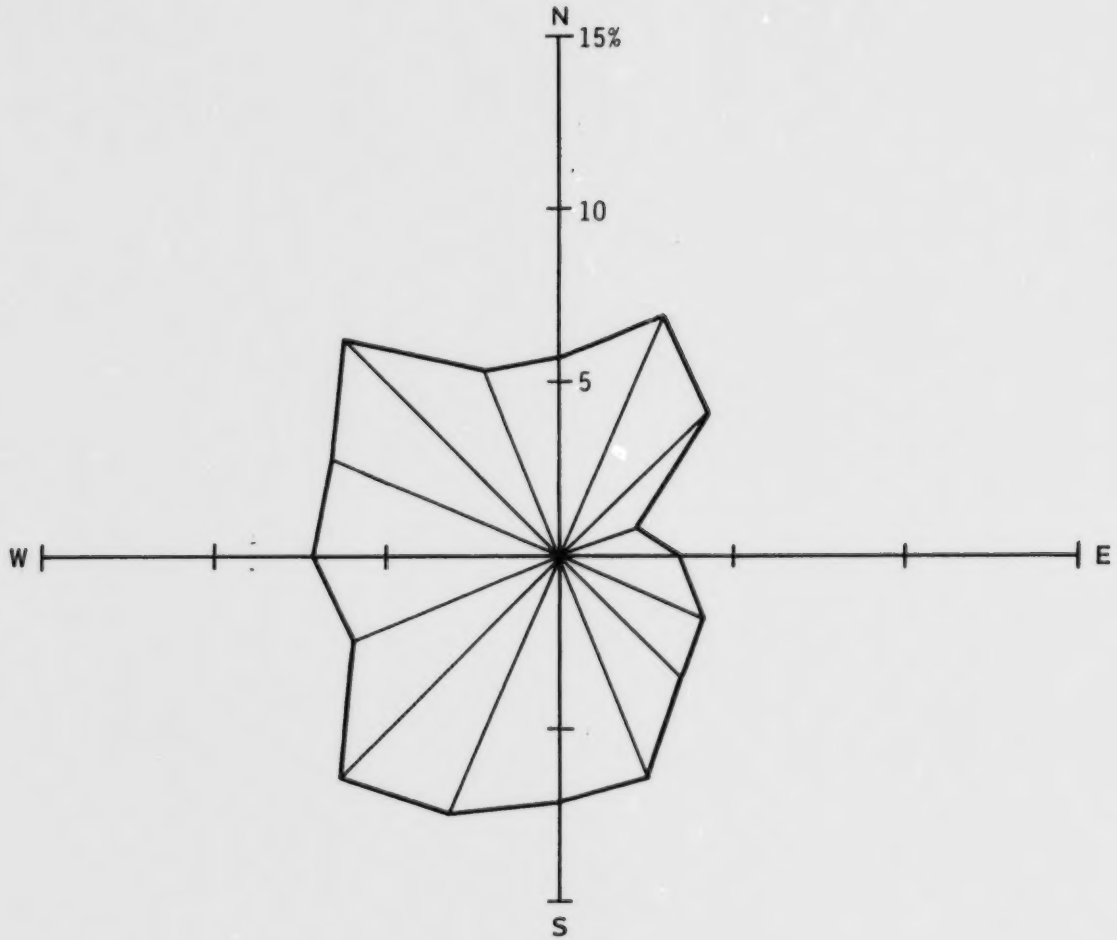

FIGURE 5

WIND DIRECTION FREQUENCIES
LAMBTON TGS 1983 - 1985

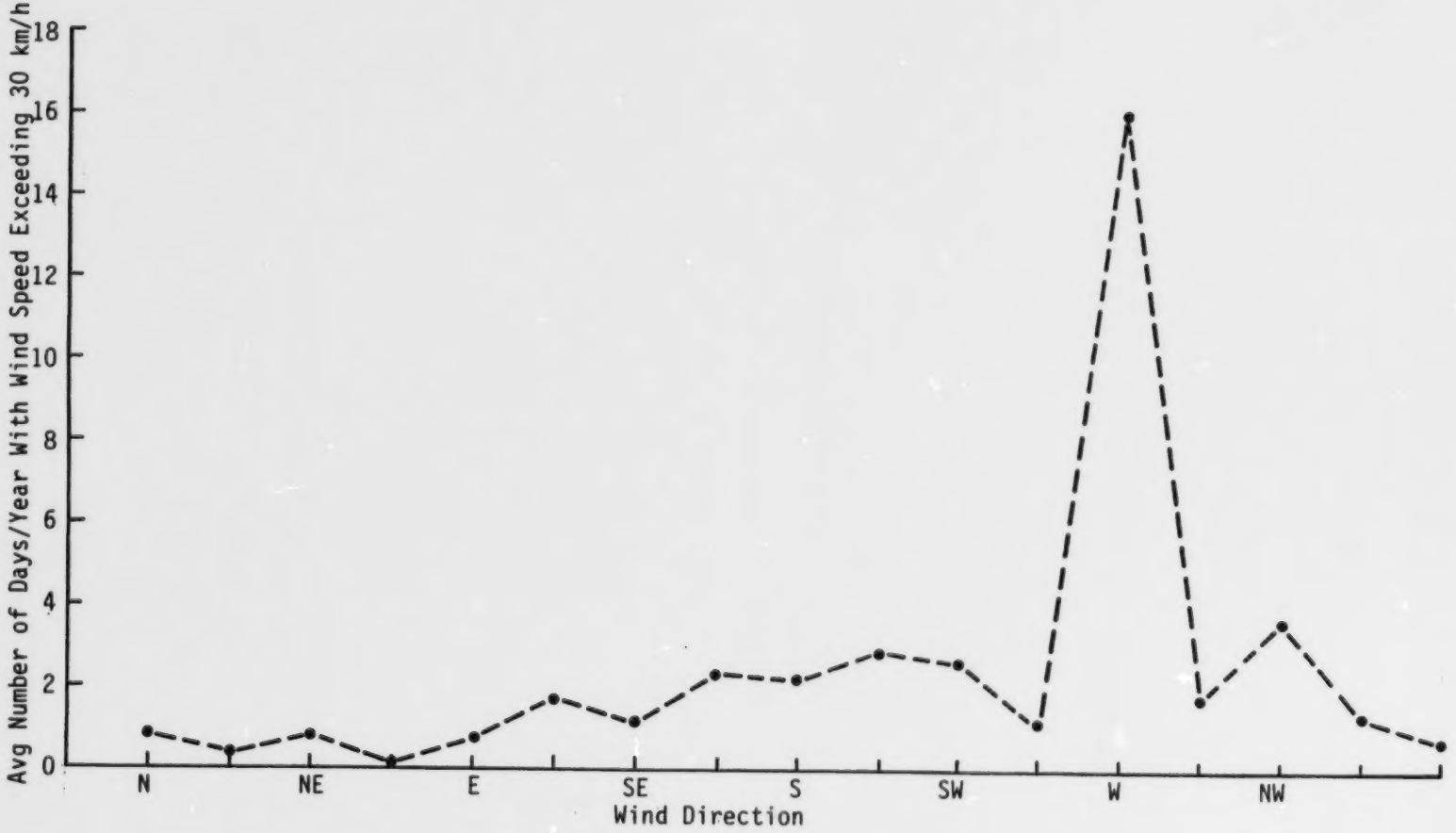

FIGURE 6

LAMBTON TGS
FREQUENCY OF WIND OVER 30 km/h BY DIRECTION

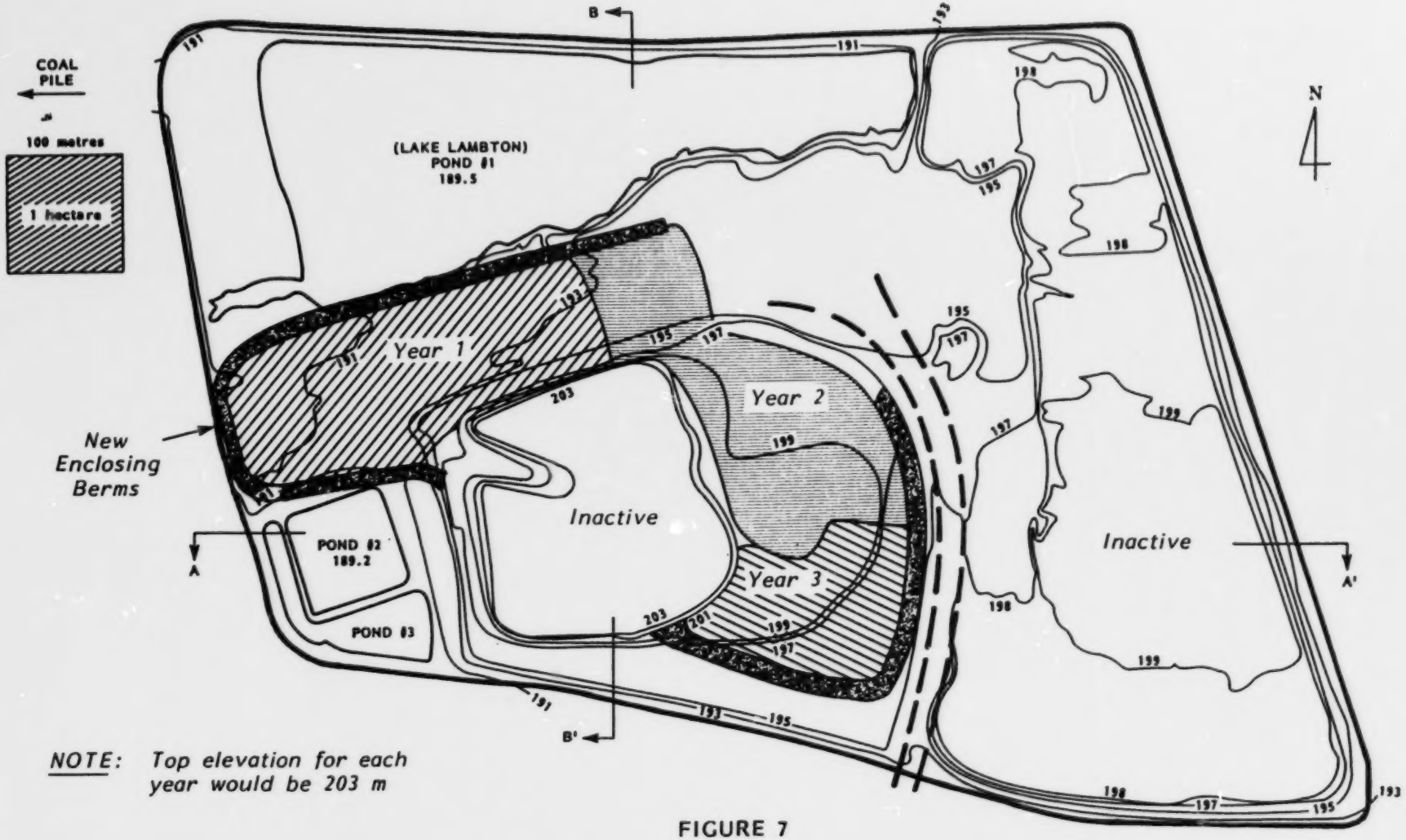

FIGURE 7

LAMBTON TGS
ASH STORAGE AREA
EXAMPLE FILL SEQUENCE FOR 3 YEARS

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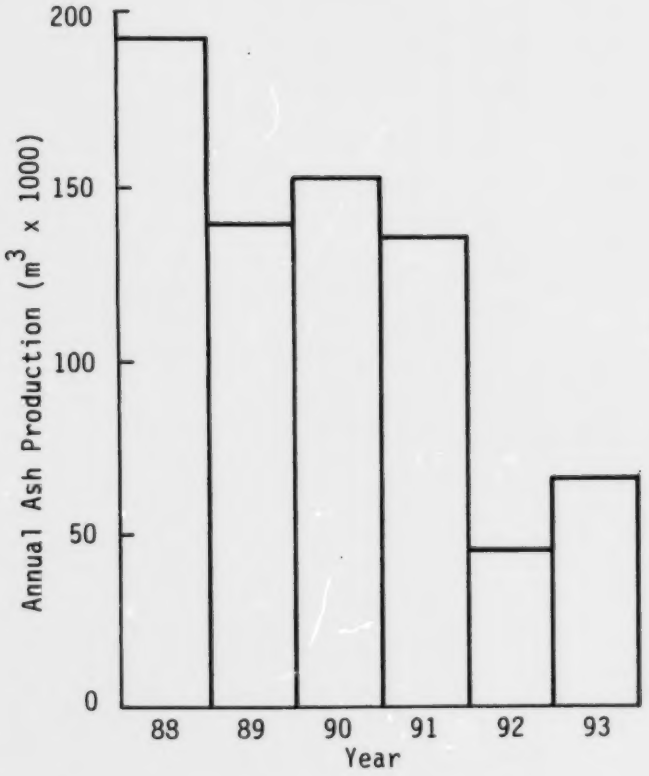

FIGURE 8

ESTIMATED ANNUAL ASH PRODUCTION AT LAMBTON TGS*
1988 - 1993

** Estimates Based on Consistent Energy Set #88-2*

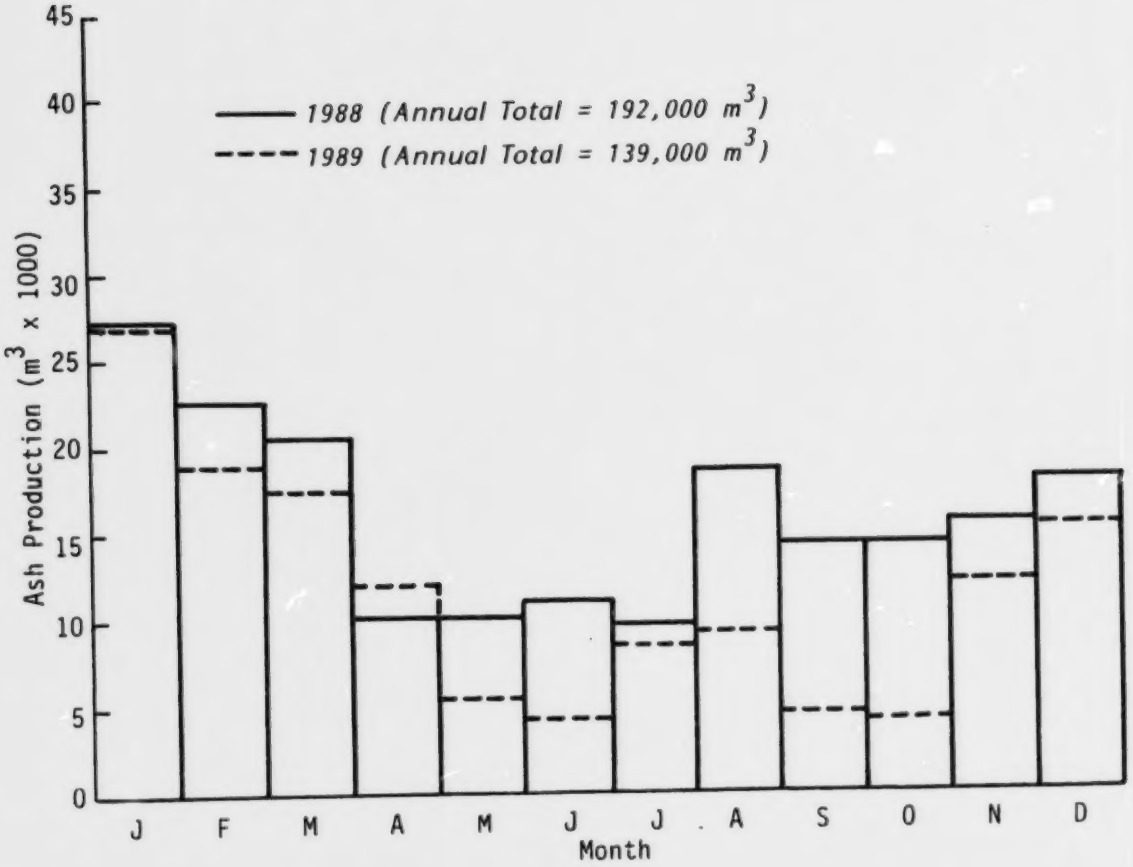

FIGURE 9

ESTIMATED MONTHLY ASH PRODUCTION AT LAMBTON TGS
1988 - 1989*

* *Estimates Based on Consistent Energy Set #88-2*

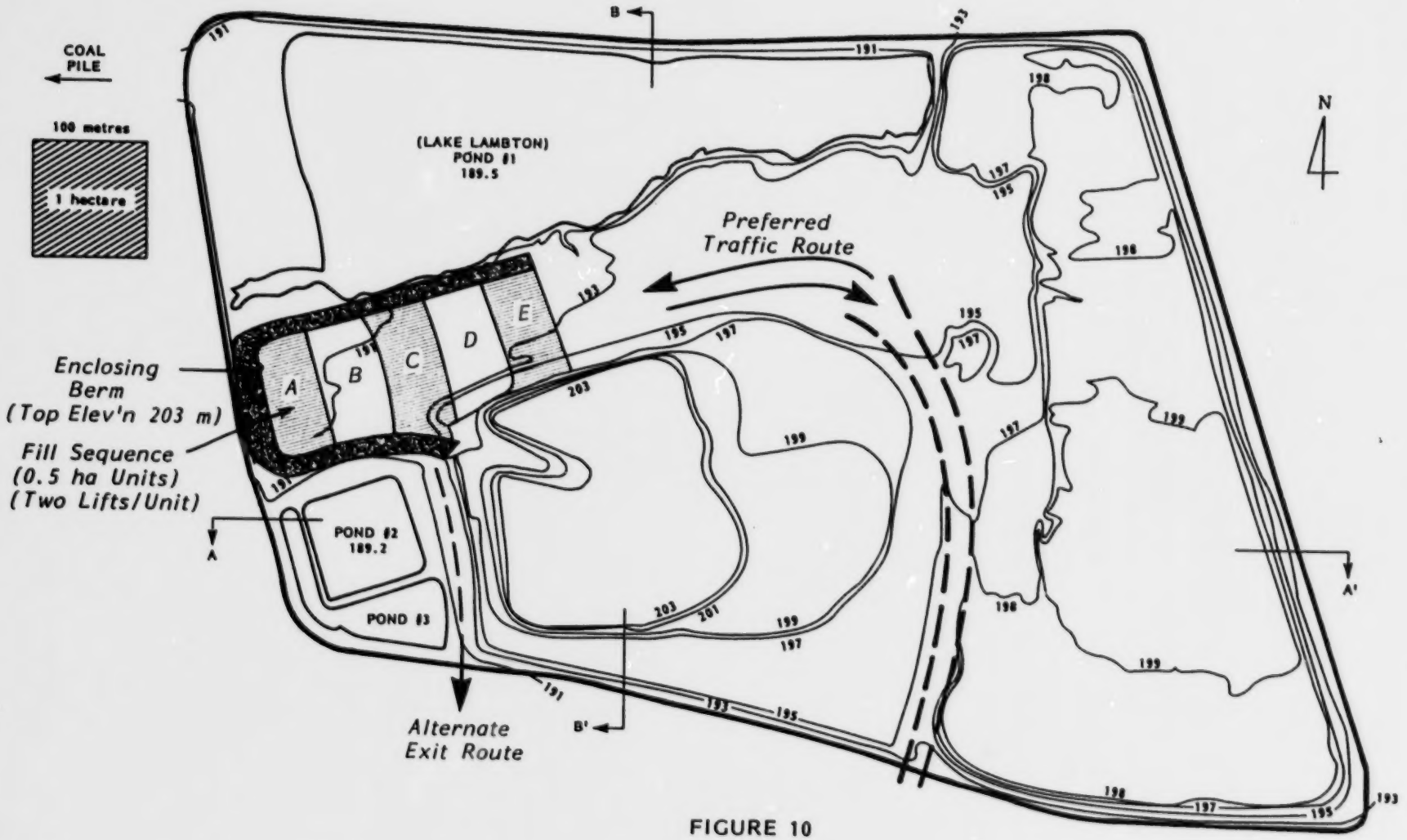

FIGURE 10

LAMBTON TGS
ASH STORAGE AREA
EXAMPLE FILL SEQUENCE FOR ONE YEAR

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